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Debbie Raphael, Director
Department of Toxic Substances Control
California Environmental Protection Agency
1001 I Street, 25th Floor
Sacramento, CA 95814

Dear Ms. Raphael:

The California Department of Public Health (CDPH) is responding to your request of May 30, 2013, to review data available for the Autumnwood area in the City of Wildomar, Riverside County. This letter specifically addresses the health and exposure concerns expressed by several Autumnwood residents. This Letter Health Consultation (LHC) was written under CDPH's Cooperative Partnership Agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). The LHC does not assess potential health risks for each residence. Rather, we evaluated the information provided to determine if there are potential "commonalities": conditions similar for the residents of the Autumnwood development, but distinguishable from other areas and from background conditions. In doing so, CDPH staff:

1. Reviewed the residents' reported health conditions and symptoms;
2. Reviewed the available environmental data and identified data gaps;
3. Consulted with CDPH's Indoor Air Quality Program regarding the assessment of indoor air;
4. Provided recommendations for concerned citizens.

Background

Autumnwood is a residential community located in the City of Wildomar, Riverside County, between Los Angeles and San Diego (Figure 1). It consists of 61 homes built between 2004 and 2007, with the first residents moving in during 2006. The Autumnwood development is bounded by Palomar Street on the Northeast, S. Pasadena Street on the Southeast, Front Street on the Southwest, Penrose Street and private properties on the Northwest (Figure 2). Autumnwood Residents reported numerous health concerns after moving in, especially in Amaryllis Court, prompting

deaths (no causes given), three life-threatening conditions (not specified), seven cases of pneumonia, one case of leukemia, and others.

The "Measle Map" showed that the reported health concerns were varied and widespread, but appeared to be concentrated in Amaryllis Court and the northern end of Pink Ginger Court. The symptoms reported first and prominently by the residents are respiratory (i.e., asthma, lung congestion, throat irritation, hacking cough, sinus congestion/infection, runny nose, and sore throat), mucous membrane (eye) irritation, and dermatologic (rashes, redness). Other symptoms reported include allergies, ear pain, headaches and excessive thirst.

Data limitations: It is not known how many of the Autumnwood residents responded in the spreadsheet or "Measle Map." The health concerns of this self-selected group may or may not be representative of the residents of the entire Autumnwood development; the reported health conditions are often nonspecific (GI problems, brain fog); it is not known which - if any - of these symptoms/conditions were present before residents moved to Autumnwood; no information was provided regarding when these symptoms started; and the exposure history (occupational and non-occupational) and medical history of the residents are unknown.

Conclusions: The list of symptoms and conditions reported by the residents cannot easily be explained or analyzed. This is particularly true for diseases that take a long time to develop (such as cancer). The indoor environment in each household is different and each person has a different medical history and genetic heritage, and has been exposed to different chemical, physical, and biological agents, depending on their lifestyle and environment (such as time spent at home, work or school, outdoors or indoors, hobbies, use of personal care products, smoking, and many others). It is highly unlikely that a single agent or environmental condition caused all of the reported symptoms and conditions mentioned. In any given population many of the same conditions/symptoms will be reported (including serious diseases and deaths, but more commonly headaches, insomnia, GI problems, and others stated in the documents). Focusing only on concerns reported by 50% or more of the 50 residents, symptoms and health conditions related to irritation (respiratory, mucous membrane, skin) seem to present a kind of "commonality." However, many of these symptoms could also be attributed to common allergies¹.

For the purpose of this assessment, CDPH staff focused on the possibility that agents causing irritation may play a role in some of the reported conditions at Autumnwood.

¹ <http://www.aaaai.org/about-the-aaaai/newsroom/allergy-statistics.aspx>

- *Drinking water.*

None of the residences have private drinking water wells. All residents receive the same drinking water as other residents who reside in Wildomar, provided by the Elsinore Valley Municipal Water District (EVMWD). No exceedances of the primary drinking water standards have been reported from EVMWD to CDPH's Division of Drinking Water and Environmental Management (DDWEM). On June 16, 2013, tap water was collected at five homes and showed that Total Dissolved Solids (TDS) slightly exceeded USEPA's Secondary Drinking Water Standard, which is based on aesthetics (odor, color, smell, taste), not on health effects. All customers of EVMWD receive this water, which does not present an exposure unique to the Autumnwood residents.

- *Recycled water.*

Based on information from DDWEM (Dr. D. Mazzera, phone call on July 15, 2013), recycled water is not currently flowing in the pipes reserved for "Recycled Water." These pipes are present in the Autumnwood development, but recycled water has not been connected to the system. No exposure to recycled water has occurred.

- *Fill material.*

Several residents reported concerns regarding the soil or fill material on their parcels: debris/trash mixed with their soil, a "white substance" on the surface, skin rashes upon contact. Residents also associated odors (chemical, petroleum, sewage) with the soil. Inspectors' field notes taken during the grading phase indicate that materials with high organic content, such as trash, plywood, tires and debris, were brought on-site, but that the contractors removed unsuitable materials. It cannot be determined where the fill material and unsuitable content were placed, how much unusable material there was, and the extent to which the latter was removed.

The best way to determine what compounds were present in the fill material is to sample and analyze the soil. Therefore, seven soil samples were collected in the front yards of houses on Amaryllis Court (A. Adini report, prepared for Swanson Law Firm, tab 1.15). Soil sample borings reached a depth of 10 ft below ground surface (bgs). The soil type was reported as mostly brown sand down to 10 ft., with no indication of organic or artificial debris, no odors, and no evidence of chemical contamination. Groundwater was not encountered and none of the boring logs indicate that fill material was encountered. Up to six soil samples from 3 ft., 5 ft. and 10 ft. bgs were analyzed for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPHs), semi-Volatile Organic Compounds (sVOCs), organochlorine pesticides (OCPs), and polychlorinated

- *"Chinese Dry Wall (CDW)."*
None of the residents reported problems that have been associated in the past with CDW (blackened or deteriorating copper pipes).
- *Vegetable and fruit gardens.*
According to information provided by N. Carraway, none of the residents use homegrown produce that would contribute significantly to their diet.

Factors that may or may not play a role

Based on the limited information provided, CDPH cannot ascertain whether or not the following conditions/agents present a "commonality" for the Autumnwood community, or play a significant role in explaining the reported symptoms and conditions:

- *Mixtures of VOCs in indoor air.*
Individual VOCs detected in indoor air are discussed below. Scientific evaluations of toxicity and health risk focus mostly on a single compound or closely related compounds. Increasingly, there are efforts to describe human health effects of exposure to multiple chemicals at the same time. Studies have shown that the health effects from exposure to some chemical mixtures can be more harmful than exposure to each chemical alone³. For other mixtures, the combined exposure may reduce harmful effects of individual chemicals. While research on this topic continues⁴, current methods are not sufficient to evaluate toxicological interactions from exposure to complex mixtures, such as found in indoor air samples at the Autumnwood residences. For the above reasons, CDPH and ATSDR staffs concluded that since the evaluation of possible combined effects of mixtures is beyond the scope of current methodology, a mixture evaluation based on the indoor air samples will not be attempted.
- *Groundwater.*
VOCs in soil gas may originate from contaminated groundwater, which could present a "commonality" for the Autumnwood homes. However, the hydrogeology of the Autumnwood area is not well studied and groundwater samples were not collected during any of the investigations reviewed in this LHC. The Adini report (tab 1.15) states that regional groundwater flows towards the south-southeast and that the groundwater table is likely to be between 12 and 28 ft bgs. No water was encountered down to 15 ft bgs under Amaryllis Court in the dry season (September 2012). It is possible that the water table is higher during the wet season. The presence of halogenated VOCs in soil gas and sub-slab soil gas samples (discussed below) indicates release of anthropogenic materials into the environment. An explanation for the presence of VOCs in soil gas would be the

³ http://www.atsdr.cdc.gov/HAC/pha/KellyAFB-PC101204/KellyAFB_appendC-D.pdf

⁴ <http://ehp.niehs.nih.gov/1206182/>

could contribute to some of the health complaints. The following paragraphs discuss conditions that may affect indoor air quality in the Autumnwood homes that were investigated.

a) VOCs in indoor air samples

General description and data limitations: Indoor air samples were collected from 12 of 61 homes in 2012 and 2013. Some were sampled multiple times. The analyses were conducted by Air Technology Laboratories (AirTechLab) and the laboratory of the SCAQMD. Some homes were vacant during sampling, others were occupied. In addition, four homes of the 12 were tested separately for formaldehyde (no laboratory indicated, tab 1.20). The SCAQMD's analyses included identification of all peaks seen in the Total Ion Chromatogram (information from Rudy Eden, SCAQMD). Some of the compounds identified by the SCAQMD were not analyzed by the AirTechLab (1,3-butadiene, acrolein, and others). Other compounds identified by AirTechLab were not analyzed by the SCAQMD (1,1,2,2-tetrachloroethane and others). The control samples from 7/26/12 (AirTechLabs: sampling train study, blank, tab 1.11) detected 18 VOCs at low concentrations (among them dichlorofluoromethane, chloromethane, benzene, toluene, ethylbenzene, toluene, and carbon tetrachloride). This gives rise to the possibility that these VOCs were introduced during sampling and/or analysis (for example: contaminated canisters, gas, sampling train setup). Low levels of these 18 VOCs found in indoor air may therefore be false positives. However, some of these compounds were found at higher concentrations in indoor air and they were also identified in the indoor air samples that the SCAQMD analyzed.

CDPH staff identified the following Chemicals of Concern (CoCs) by comparing the highest detected indoor air concentration to the California Human Health Screening Levels for residential indoor air (CHHSL)⁵ developed by OEHA: carbon tetrachloride, benzene, 1,2-dichloroethane, trichloroethylene, tetrachloroethylene and ethylbenzene. CDPH staff compared the following compounds with other screening levels because there are no CHHSLs for them: formaldehyde (three out of four homes exceeded ATSDR's acute Minimum Risk Level (MRL)⁶ and all exceeded the USEPA Regional Screening Level (RSL) for residential air⁷); 1,3-butadiene (exceeded RSL); 1,2-dichloropropane (exceeded RSL), acrolein (exceeded RSL) and 1,2-dibromoethane (exceeded RSL). 1,2-dibromoethane was found in all homes in the first sampling round of SCAQMD

⁵ CHHSL: <http://oehha.ca.gov/risk/pdf/screenreport010405.pdf>

⁶ ATSDR MRL: <http://www.atsdr.cdc.gov/mrls/mrlist.asp>

⁷ USEPA RfC: <http://www.epa.gov/region9/superfund/prg/>

Formaldehyde was found in all four homes tested. It is a strong irritant gas commonly found in indoor air. Exposure can affect the skin, GI tract, immune and respiratory systems. The International Agency for Research on Cancer (IARC) considers formaldehyde to be carcinogenic to humans. The sources in indoor air are often building materials (insulation, plywood, resins, and glues), furniture and others⁹.

1,2-dichloroethane (also known as ethylene dichloride) was found in both AirTechLab and SCAQMD samples. Exposure can affect the liver and kidneys and is considered by IARC to be possibly carcinogenic to humans. It is used in plastic and PVC manufacturing, as a solvent, in furniture, wall coverings and automobiles. It dissolves in water but does not quickly break down in water or air¹⁰.

1,2-dibromoethane (also known as ethylene dibromide) was found in all three homes tested by the SCAQMD during the first sampling round. The detection limits in the AirTechLab samples were fairly high (0.15 – 1.5 µg/m³) and the compound may or may not have been present at lower concentrations in these samples. 1,2-dibromoethane affects the skin, liver, kidneys and the reproductive system. It also causes nasal inflammation and is considered by IARC to be probably carcinogenic to humans. In the past, it was used as a pesticide (before 1984) and as an additive to leaded gasoline. Current uses include “treatment of logs for termites and beetles, control of moths in beehives, and as a preparation for dyes and waxes”¹¹. 1,2-dibromoethane is water-soluble, but quickly breaks down in air.

b) VOCs in soil gas and vapor intrusion

Residents of Autumnwood have voiced concerns regarding the possibility of VOCs migrating from soil into indoor air (vapor intrusion). Vapor intrusion depends on many factors, including the concentrations of VOCs in soil gas, soil type, temperature and moisture, the condition of the slab and other pathways to the indoor environment, and air pressure inside the home.

Soil gas or sub-slab concentrations of VOCs were measured in ten of 61 homes by different laboratories. The detection of low levels of organic VOCs in soil gas is expected due to natural decomposition. However, halogenated VOCs (including 1,2-dichloromethane) were also found at low levels in soil gas and sub-

⁹ ATSDR formaldehyde information: <http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=39>

¹⁰ ATSDR 1,2-dichloroethane: <http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=110>

¹¹ ATSDR 1,2-dibromoethane: <http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=131>

Known health risks for mold include: development of asthma, allergies, and respiratory infections; triggering of asthma attacks; increased wheeze, cough, difficulty breathing, and other symptoms. Available information suggests that children are more sensitive to dampness and mold than adults. In addition, evidence is accumulating that the more extensive, widespread, or severe the water damage, dampness, visible mold, or mold odor, the greater the health risks¹.

Conclusion: Moisture and dampness appear to be pervasive problems in homes in the Autumnwood development. It is likely that mold and/or dampness problems exist in many homes. Rather than identifying specific molds in the indoor air, CDPH recommends addressing sources of moisture/dampness and removing moldy material.

d) Other sources of indoor air pollution

As stated previously, the indoor air quality in homes depends on many factors, such as those listed on page 8 of this document. While some variables, such as the weather, can't be controlled, others can, including HVAC settings (which are critical to allow sufficient air exchanges in newer "air-tight houses"), the frequency and duration of opening of windows/doors, use of air fresheners, gas and wood stoves, keeping pets indoors, and many others.

Conclusion: To determine other contributing factors to indoor air quality, CDPH staff recommends an "inventory" of the interior of the individual homes (Step 8 of DTSC's Vapor Intrusion Guidance¹³). Based on this knowledge, the residents can reduce or eliminate potential sources of VOCs or other agents.

3) **Consultation with CDPH's Indoor Air Quality Program regarding the determination of indoor air quality**

CDPH's Indoor Air Quality Program provided information on mold (see above) and references for the ASTM International Method D7297-06 "Standard Practice for Evaluating Residential Indoor Air Quality Concerns"¹⁴, USEPA's Guide to Indoor Air Quality¹⁵, USEPA's Indoor Air Quality and VOCs¹⁶, and a search engine for different Indoor Air Quality consultants from the American Industrial Hygiene Association¹⁷.

¹³ http://www.dtsc.ca.gov/AssessingRisk/upload/Final_VIG_Oct_2011.pdfGuidance

¹⁴ <http://www.astm.org/Standards/D7297.htm>

¹⁵ <http://www.epa.gov/iaq/pubs/insidestory.html>

¹⁶ <http://www.epa.gov/iaq/voc.html>

¹⁷ <https://webportal.aiha.org/custom/consultantsSearch.aspx>

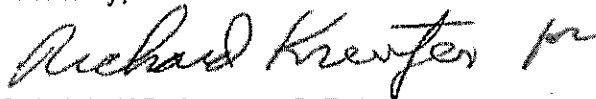
- Remove indoor ozone sources: Although ozone was not analyzed in the indoor air samples, some occupants still use ozone-generating "air purifiers." Ozone is a strong irritant, and indoor air sources of ozone should be removed¹⁹.

Summary and Conclusion

In this evaluation CDPH staff reviewed numerous reports, environmental data, and self-reported health concerns of Autumnwood residents to try to identify factors that would distinguish the Autumnwood development from its surroundings ("commonalities"). The many diverse health concerns and symptoms reported by the residents are highly unlikely to be due to a single factor. Based on the review of the health concerns and the environmental data, CDPH staff concludes that the reported presence of moisture, dampness and/or mold, and exposure to irritants in indoor air may be significant factors in homes in the Autumnwood development. Specifically, the gases formaldehyde, 1,2-dichloroethane and 1,2-dibromoethane were detected in multiple Autumnwood homes at concentrations exceeding non-cancer and cancer-based health screening levels. These agents may have contributed to some of the reported symptoms and conditions, but could not explain all of the varied health concerns of the residents.

If you have any questions, please do not hesitate to contact me at (510) 620 3610.

Sincerely,



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¹⁹ <http://www.arb.ca.gov/research/indoor/ozone.htm>

Appendix: Figures and additional resources

Figure 1: City of Wildomar, Riverside County, California

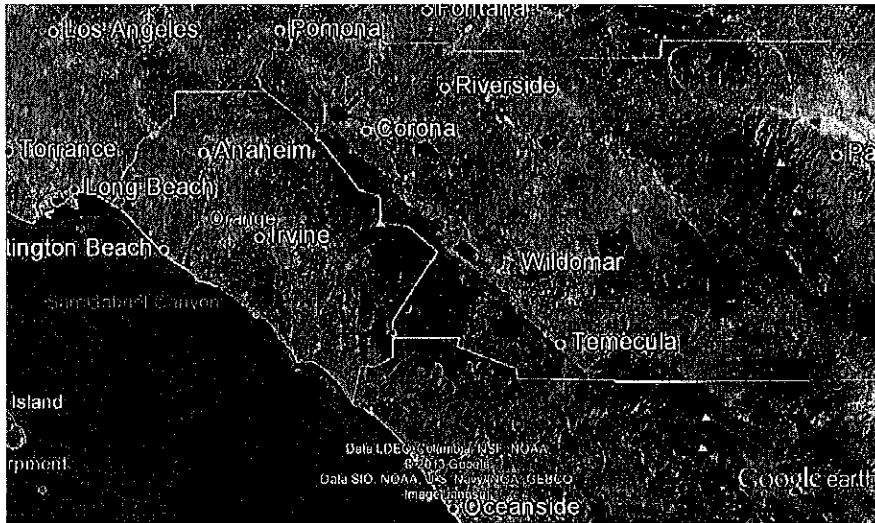
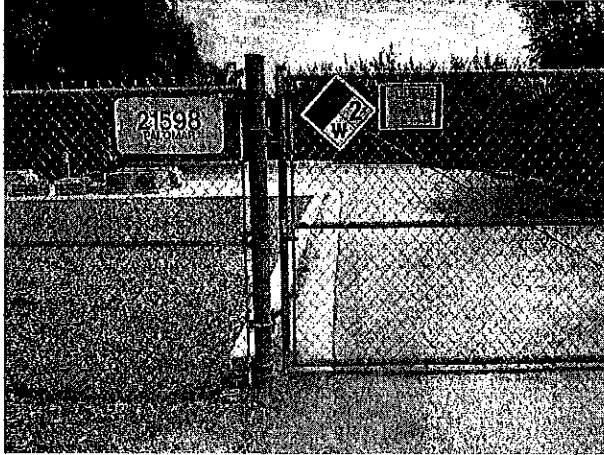


Figure 2: Autumnwood Residential Community in the City of Wildomar



Figure 5: Verizon Facility at 21598 Palomar Road



Additional Resources

CDPH information on Indoor Air Quality (IAQ)

<http://www.cdph.ca.gov/programs/iaq/Pages/default.aspx>

USEPA information on IAQ

<http://www.epa.gov/iaq/>

CDC information on IAQ

<http://www.cdc.gov/healthyhomes/bytopic/airquality.html>

CDC information on mold

<http://www.cdc.gov/mold/>

Lawrence Berkeley National Laboratory on IAQ

<http://www.iaqscience.lbl.gov/overview.html>